Urban Sim—A Tool for Land Use Planners

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UrbanSim is a software-based simulation model for integrated planning and analysis of urban development, incorporating the interactions between land use, transportation, and public policy. It is intended for use by Metropolitan Planning Organizations (MPO) and others needing to interface existing travel models with new land use forecasting and analysis capabilities. The UrbanSim software, including full source code, is available for download via this website. It is licensed under the GNU General Public License, which means it is free, open source, and any derived works are also covered under the license. The intent of this licensing approach is to avoid proprietary obstacles and costs, and to facilitate collaboration between researchers and practitioners in improving land use and transportation planning and policy.

The web site is the official site for access to UrbanSim software and documentation, and is hosted by the University of Washington as part of the Urban Simulation Project. Version 2.2 of UrbanSim is now available for download at **http://www.urbansim.org/people/index.shtml**. It is made available for use as an initial product, to solicit feedback and suggestions, and to encourage collaboration in its further development and use. We plan to continue development of the system and release new versions as they are completed. UrbanSim is the centerpiece of the research activities of the newly formed Center for Urban Simulation and Policy Analysis, located at the Point 5 Laboratory, on the University of Washington campus. Please contact us if you are interested in collaborating on further development of the system. If you have questions regarding UrbanSim or this web site, please contact Paul Waddell at pwaddell@u.washington.edu or (206) 221-4161.

Planning Context

In recent years, we have observed increased public interest in mitigating urban sprawl and the consequences it engenders (e.g., increased vehicle miles traveled and energy consumption, increased air pollution, heightened infrastructure and public service costs, decreased resource lands). This increased public interest is supported by metropolitan agencies seeking to better coordinate land use and transportation planning efforts by more accurately accounting for environmental, sociological, and economic dimensions. Local policy debates that surround these concerns address ways to shape urban development, including issues as diverse as preserving prime agricultural lands, forests, wetlands, and open space, and juxtaposing them with issues of redevelopment, infill, and inner-city decline. Ultimately, the policies being considered may range from metropolitan-scale strategies such as urban growth boundaries to neighborhood and site-scale strategies such as street design, mixing of uses, and pedestrian access. Of particular interest to policymakers are strategies to promote increasing densities, infill development, and redevelopment.

Increasing interest in developing land-use planning strategies that employ one or more of these techniques prompts planning agencies to want to forecast the likely effects of such plans and policies. The desire to "test out" such strategies has forced many MPOs to move beyond the traditional long-term baseline forecasting requirements that have dominated planning practices for decades. Because these planning agencies are now moving toward more proactive planning strategies, they are consequently looking to employ the forecasts from land use and transportation models as the primary tool for such analysis. The policy instruments used to leverage development trends and patterns, however, are too often debated and decided with little understanding of the underlying forces shaping urban land, labor, and transportation markets, and therefore lead all too often to unintended consequences and inefficiencies. A process to integrate the analysis of market behavior with the analysis of land policies and infrastructure choices is needed to facilitate more informed public investments and choices.

Model Description

It is within this planning context that the UrbanSim model has been developed. The model implements a perspective on urban development that represents a dynamic process resulting from the interaction of many actors making decisions within the urban markets for land, housing, non-residential space and transportation. For example:

- Households make choices about whether to move, and if they move, where to locate.
- Businesses make similar decisions.
- Developers make choices of what properties to develop or redevelop and into what use, at what density and scale.

- Governments make infrastructure investments, and place constraints on development in the form of land use plans, density constraints, environmentally-sensitive land restrictions, urban growth boundaries, and many other policies.

By treating urban development as the interaction between market behavior and governmental actions UrbanSim is designed to maximize reality, thereby increasing its utility for assessing the impacts of alternative governmental plans and policies related to land use and transportation. Thus, the model design enhances the strategic planning capabilities of MPOs and other state and local agencies needing to evaluate growth management policies such as urban growth boundaries, assess consistency of land use and transportation plans, and address conformity with respect to air quality implementation plans.

Running the model requires exogenous input information derived from:
- Population and employment estimates.
- Regional economic forecasts.
- Transportation system plans.
- Land use plans.
- Land development policies such as density constraints, environmental constraints, and development impact fees.

The user interacts with UrbanSim to create "scenarios," specifying alternative packages of forecasts, land-use policy assumptions, and other exogenous inputs. The model is then executed for a given scenario, and the results of one or more scenarios can be examined and compared.

Output Information

UrbanSim excels in its flexibility to disaggregate households, businesses, and land use. The classification detail is a function of the needs of the user and available data, but as currently structured, its output information includes:
- Future year distributions of population.
- Households by type (e.g. income, age of head, household size, presence of children, and housing type).
- Businesses by type (e.g. industry and number of employees).
- Land use by type (user-specified).
- Units of housing by type.
- Square footage of nonresidential space by type.
- Densities of development by type of land use.
- Prices of land and improvements by land use.

In the area of user-benefits, there is considerable controversy about what the most appropriate measures are, and therefore there are a variety of measures provided in the evaluation component. Transportation infrastructure characteristics are input by the user to the travel demand modeling process. The model does not predict infrastructure characteristics, but can use such information to predict development. Components exist to add functionality to account for the costs of infrastructure as part of the evaluation of alternative scenarios.

UrbanSim as a Planning Tool

By developing a model that is behavioral in its approach, the operation of UrbanSim becomes fairly simple to understand, but is able to capture complex interactions in the markets for land, development, and transportation. It is a valuable tool for improving the level of understanding of how a metropolitan region is developing and how various combinations of land use and transportation policies and investments are likely to shape these trends. Some of the issues of interest, such as affordable housing, are within the scope of the model to be of use, since it deals with predicting housing prices, and disaggregates households by income as well as other characteristics, and can capture the affordability impacts of alternative scenarios. Preservation of land in green space would be feasible to incorporate within the model by earmarking specified parcels for green space preservation, which would influence the supply of land, and could be tested as an attractor for residential or business location. Urban design issues could similarly be explored, given the parcel-level capacity of the developer module, and the ability to incorporate a flexible set of terms in the location choice equations for businesses and households. The specific abilities to test these and other policy issues of interest depend on myriad factors being considered as this planning tool evolves.

For more information about UrbanSim, visit http://www.urbansim.org/people/index.shtml